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DEEP SEA FISHING

Brief History of Towed Trawling

The methods of trawling are grouped into 2 divisions, known as the puertas or bou towed by a single boat, and the pareja, towed by a pair of boats. The minor methods of bou are also known as the baca or vaca method. It appears that the French were the first to utilize these methods off the coasts of Catalonia and Valencia about the beginning of the 18th Century. The names of bou or busy, and parellas or pairs are undoubtedly given because of the similarity between a boat or both boats trawling the net which furrows the deep, and a pair of oxen or mules yoked to the plow. Under any circumstances these names are of Spanish origin, inasmuch as those used in France at the beginning of the 18th Century were draige or drague, that is, dredge, in imitation of the machine which excavates mud and sand from the sea bottom.

Arcachon was the first port to utilize motorboats for trawl fishing. A short time after these methods had found favor along the Spanish coasts, others began to adopt them. Our own fishermen were astounded by the abundant catch.

Opposing interests arose to sow discord. However, the proper use of these methods is a source of wealth; the minimum depth limits must be observed, and the gauge of the mesh must be fixed so that it does not systematically destroy the small catch.

Technique of Towed Trawl Fishing

In 1934, the International Board of Sea Resources called attention to the decreasing stock in the fishing grounds of the North Sea, which are the most plentiful in the world, and to the fact that the damage was due to the intensive destruction of small-size fish. After an inquiry for the conservation of small-size fish, a test was conducted with the following conclusive results:

By agreement with an English trawling company a test was made under strict business conditions. Two sister ships equipped with identical

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tackle, except for the difference in mesh for each net, made 12 scientifically regulated trips. Observers from the ranking personnel of the Department of Fisheries were aboard on each trip, noting in detail the catch of every cast, including little fish (which the fishermen call sruff), and changing nets on each trip to avoid the influence of personal factors. They worked as closely as possible, keeping contact by radio telephony, paying out and tacking simultaneously. The results of all the casts were equal, except for about eleven pounds in favor of the wide mesh net. The wide mesh caught considerably more large-size fish than the standard commercial mesh. This was true on all the trips, and although the wide mesh does not hold much small fish, it certainly does not lessen the value of the cast. It is believed that an increase in the number of boats engaged in trawling and the perfecting of these methods are contributing to a disappearance of the fish species, and there is some truth in the matter. The living reserves of the marine world are apparently enormous, and yet we must recognize that intensive trawling carried to the n^{th} degree contributes to the decrease of fish, or to driving them to difficult grounds. Bottoms that are often scraped suffer biological changes and the fish of local habitat leaves because even the coral which gives them refuge is destroyed by intensive dragging.

It is known by all fishermen that a long period of calm drives fish from far-off grounds closer to shore.

After storms and during the heavy surf caused by them, fish remain in deeper waters. This leads one to think that the pounding of the sea on the coast, stirring the bottom and agitating the lower layers of water, makes it difficult for the fish to remain there; a change in temperature or the chemical conditions of the water will produce similar effects.

Having admitted the minor shifts of habitat for the species and the influence of physico-chemical phenomena in the change of bottoms, a practical consequence is: "The Captain or master who changes grounds most often will not catch as much fish as the one who explores the various bottoms of a single ground with his nets."

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A superficial study of the annual fishing done with boats based in Coruna has proved:

- 1) The best fishing was done by boats which made a habit of working over a single area.
- 2) Boats which constantly changed grounds did not catch enough. They have become known as fuel burners.
- 3) Another reason for driving fish from their grounds is the presence of numerous boats which make the water turbid and crowd the grounds. A few boats on the same ground will do well, but with the arrival of more, the fish may disappear. It is a serious error to search for boats or to keep a watch on the radio for the same purpose. Every captain or master must act independently, keeping a complete daily log. After a time the smooth log will become his best source of information. Fishing is not just pulling fish out of the water; it is knowing when to pay out the line, what to catch and how. He must observe and study the abundance and alternatives of the exploited area and investigate the existence and nature of other areas.

The intelligent captain or master should know:

- 1) Depth and nature of the bottom of the area to be exploited
- 2) Direction and speed of the current
- 3) Wind direction
- 4) Proper time for fishing, dependent upon the variety to be caught

Concerning his tackle, he should know:

- 1) Power developed by his gear to haul in his line and the maximum effort borne by its parts
- 2) Weight of entire tackle, empty and loaded, and the effort needed to bring it in.
- 3) Rupture load of the main parts of the line and the steel towing cable.

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Bou Method**Paying out the rig**

As mentioned above, notice the wind direction and heave down on the payout side, keep steady, know the direction of the current, or sea if any, to keep the rig clear of the side. When the ship is in position, begin.

Payout the drop until it is in water and wait until it is clear of the side.

Payout the rest of the rig, including the rods; give the stern only about 3 fathoms of line, and give the bow enough to leave the rod awash about midship.

Make fast the netlines.

Go ahead slowly with the helm locked to the payout side, and after stretching open the rig, let go again.

When the netlines [malletas] haul through the kites or puertas, stop the engines and payout the puertas to the water letting out about 1 1/2 fathoms of cable.

When the screw is clear after this, go ahead full, with the helm almost at way on [a la via] and the ship making headway only enough for the payout side, so that the cables or puertas do not foul the screw.

Unwind the cables equally until the marks appear (50 fathoms to a mark). In paying out, the marks unwound are in proportion to the depth. The following is recommended: in 100 fathoms of water, 6 marks of cable; in 200 fathoms, 12 marks, that is, 3 times as much cable as the depth. Beyond 250 fathoms, the rule is 3 times as much cable as the depth, less one mark. Example; in 300 fathoms of water, pay out 850 fathoms of cable.

Having unwound the marks ordered by the officer in charge of fishing, set the engines at dragging speed, dependent on length of cable, nature of the bottom and force of wind or sea.

The ~~resembling~~ line hook is hooked to the bow cable, rigging the belly of the ~~resembling~~ line to the stern eye and the cable end,

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carried to a head of the block [maquinilla] and wound until the 2 cables reach the snatch block in the stern cheeks, into which both cables are reeved, and you are ready to drag.

Winding or hauling in the rig

To heave, lock the helm on the rig side, then throw the snatch block cables, and stopping the engines, begin winding.

With heavy seas and wind, turn over the engines to keep the ship trim ahead until the rig is ready to be hoisted.

Stop the engines, turning the rig side to windward and winding until the kites are on the davits.

Slip the medium rods [medias canas] from the kites [puertas], fasten them to the cables or stoppers, and wind until the net rods [calones] come alongside; lash the net rods by rigging them in the cat eyes on the gunwales.

When the rig is in this position, slip the cable ends of the 2 reeving lines from the rods which are fast to the tassels [borlones], carry the tackles to the head of the block on the rig side, and wind until the bocana is aboard.

Having overhauled the cork, the rig is hoisted aboard by hand until the sack is clear of the side; hook it to suspend it on deck with the block, and after opening the mouth of the net, let the fish fall.

When heaving the rig in calm weather, wind with the ship lying to, and when the kites are in the davits, lock the helm on the rig side, putting about so that it will stretch open the rig and keep it from clinging to the side.

Supplementary information

The bow cables in greatest use at present have a diameter of 18 to 20 mm, depending on the size or power of the ship. At any rate, the thinner the better, and the more capacity. The cables are marked at 50-fathom intervals, with strands of tarred hawser which are spliced in the cables.

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The puertas or underwater kites which keep the rig open on the bottom are about 3 meters long and 1.4 meters wide. The rig is a special net, almost funnel-shaped and has 2 wings and a tail. It has 4 or 5 different meshes, with the smaller mesh at the bottom of the drop.

The baca or vaca method is almost the same as the bou, except that the 2 stoppers which take the towing hook are attached to the port and starboard cables respectively. Most bacas have 2 davits, one on either afterside, whereas the bou has both davits on the same side.

PAIR METHOD

Paying out

Paying out astern. The first thing to be done is to ready the rig with its floats and chains, lashing the 2 rods by their stoppers to port and starboard.

The drop is paid out while making slow headway, so that the goleron, claro, anteclaro and mouth of the rig, with cheeks, floats and chains pass by.

The vessel goes ahead at half while the other vessel approaches and pays out a sisga which has the turning shackle of the line. Then the first vessel hooks this turning shackle to the rod on the same side and also hook theirs to the other rods of the rig, so that the line is fast to the 2 wings of the rig, slipping the stoppers and beginning the payout at the speed desired for the trawl.

The entire rig goes over at the speed of the 2 vessels, but when fully paid the towing power of both vessels must be equalized. If not, the rig will foul at the very start.

The vessels should be 300 to 400 meters apart.

Paying out over the side

In case of wind or sea, it is well to pay out to port, with that side into the wind or sea (the rig is left on the starboard side when

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heisted aboard). In calm weather, pay out to starboard. The rig is turned with the tail down (this is done on deck) and the rods on top are made fast to a sisga while the other vessel attempts to place its stern amidship on the starboard side of the rig ship. The rig ship pays out the sisgas bearing the rods to the other vessel, which heaves the rods aboard, securing them to the stoppers. This vessel proceeds ahead slowly, pulling the rig until it is entirely submerged, and the personnel of the other vessel sees that it goes over and keeps clear to prevent its damage.

The vessel which paid out the rig moves toward the other to receive the sisga and thus secure the turning shackle to the rod.

When fully paid out, the stopper is secured to the tow hook, and the other part of the stopper will be shackled to the mesh joint of the cable. This cable passes over the bow roller and then winds.

Hauling in the rig

First ship the stern stopper, leaving the cable on the roller and reeved on the block.

Begin hauling in the cable, then the netlines and all that while the two vessels approach each other, and when the next-to-last netline emerges it will be time to haul in one spilling line where the rod is secured, after having unshacked that of the trawl for the vessel which will ship the rig.

During the maneuver before and after paying out the spilling line, the vessels, if there is no wind, will go astern slowly so that the sack will emerge clearly.

To take the rig aboard

Loop the 2 rods and hook to the lanteon which will be reeved to the block.

Slip the stopper which secures ~~thick~~ the rods to the rodin, proceed a little ahead with the ship until the rig is amidships, wind the lanteon, and when the hook is up secure the rig to the side.

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CONVERSION TABLES

Fathoms and metric equivalents

Fathoms	Meters	Fathoms	Meters	Fathoms	Meters
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Equivalent Measures

1 meter = 3.28 feet = 39.37 inches

1 yard = 3 feet = 91.4 centimeters

1 foot = 304.9 mm

1 inch = 25.4 mm

Iron chains. Tensile strength

Dowell diameter	Weight per meter	<u>Load in Kg</u>	
in mm	in kg	Rupture	Safety

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[headings for page 26]

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Iron and Steel Cables.

Diam in mm	Weight per m in kg	Safety lead in kg Iron Steel	[repeat headings for next 4 columns]
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Tensile Strength of Materials.

<u>Hemp</u>	<u>Untarred hawser</u>		<u>Tarred hawser</u>		<u>Wet hawser</u>
	weight	Safety	Weight	Safety	Safety lead
	per m	lead	per m	lead	in kg
	in kg	in kg	in kg	in kg	

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FISHING ORIENTATION

Among professional trawling men there is a deeprooted belief that all night only flat fish such as the flounder, ray, etc., are caught, and even dories, absolutely excepting hake and small fish. However, there is little proof of this, and the same thing happens in the daytime if one fishes and trusts to luck.

It may presently be said, that on the grounds west and northwest of the Peninsula and offshore, the catch is reduced as the sun travels westward. This is not so on the rocks, where the sun is high and only flat and other fish which usually stay close to the bottom are caught.

It must be recognized that night trawling, as a supplement to day trawling, is profitable if done scientifically.

Let us examine the fishing prospects of the African coast from Cape Spartel to Cape Juby.

On the known grounds the hake, both young and adult, may be divided into 2 classes by color: white and dark lead, almost black. On the Orellana ground, having a muddy bottom, the white predominate over the very small percentage of black. However, at the mouth of the Medillak River, that is the mouth of Er Kinitra, the proportion is inverted, so that sometimes there is no white in 3 tons of hake of all sizes. We note that there used to be more night than day fishing, and that this difference is more apparent when the moon is showing, especially, from the new moon to full moon. Twenty miles southward, near Rabat there is less night fishing and the hake is generally white.

The black hake is noted for its early reproduction, A fry called temciadilla in Galicia has a splendid normal spawn which has no connection with the size of the fish; a black fry weighing a bit over $\frac{1}{2}$ kilo has a spawn as large as a white hake of 2 or 3 kilos. The white fry has no exception, and if spawn is sometimes found, the most amateur will notice that it is atrophied and covered by a muscular or fibrous weave.

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Professor Losano Pey says with regard to this black hake: "At some points near the Moroccan coast some very dark hake of tasteless flesh is caught, but has little demand on the market. It may be that these hake are suffering a parasitic disease."

All captains and masters of fishing vessels should know the fundamentals of fish caught in trawl lines, as background knowledge.

Hake (*merluccius*). The hake has always been well sought, and always bought a good price. Its catching has been widespread since ancient times. British sovereigns used to allow foreigners the privilege of fishing on their coasts in exchange for certain rights. During the 9th and 10th centuries the Danes fished off the coast of Ireland. In the reign of Queen Maria, Philip II payed one thousand pounds [annually] for the right of Spaniards to fish in Irish waters. The Germans had obtained a similar authorization from Charles II for the price of 30,000 pounds, and the Swedish kingdom was granted permission to employ about 100 vessels for this fishing.

Before fishing began on the Newfoundland Banks the salted hake took the place of cod, and because of this is often called Gulf of Gascuna cod. It is said that hake has been known for ages because of its abundance and the quality of its flesh. It appears in the list of fish which the Greek naturalists Aristoteles and Oppion drew up, calling it onos or oniskos, which means ass.

Fish were first named after land animals. We still find this lingering in the common names of sea dog, cat fish, sea horse, sea flea, etc. The ancients had noticed that the grey coloring of the hakes flanks and the large black dorsal band resembles the coloration on the hide of the ass.

The hake is a predatory fish, extremely voracious. It feeds on fish, including its own kind. Its voracity is comparable only to that of the pike. In 1553, the naturalist Belon in his work *De Aquatibus*, called it *maris lucius*, thus originating the present scientific name of the genus. *Maris luicius* changed to *mar lutius*, and finally to *merluccius*.

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The hake belongs to the suborder of the Ahaacanthini, bony fish, characterized by spineless fins, with the ventral fin jugular in position. This group comprises three families:

Merlucciidae, Gadidae, and Macruridae

The Macruridae are not edible

Until 1884 naturalists classed the hake among the Gadidae, a very important group from the standpoint of the fishing industry. This information is given by Professor Gerard Belloc in his Monographic Study of the Hake.

In 1933 Professor C.F. Hicling, an expert of the Lowestoft laboratory, wrote a fine and well-documented study of the migration and growth of the hake and of hake fishing in the northern waters most frequented by the deep-sea fishers during the summer. In this work, which contains much information of interest to the captains and owners of the fishing vessels operating in those parts, he says: "This fish inhabits both the middle and bottom depths.

"Its catch is not limited or determined by the season but, rather, is effected all year round and is based on both the adult fish and the young.

"The determination of the age of the hake and, consequently, the study of its life-history are unusually difficult because neither the scales nor the otoliths show well-defined growth rings, as in the case with the herring, sardine, robalo, and flounder. Moreover, attempts at direct observation of the growth and migrations of hake by the method of marking are still hampered by the hake's delicate nature and so far have achieved small success. We cannot therefore accept without some reservation the conclusions hitherto reached in the scientific study of the hake.

"I will confine my remarks here to the regions south and west of Ireland, since I have not studied the fishing grounds further south or those west of Scotland.

As I have said, the hake, in its habits, occupies an intermediate position between the fish which live ~~at~~ the bottom and the pelagic fish (those that inhabit the surface or intermediate depths).

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The hake rests at or close to the bottom of the sea during the day and moves in the intermediate depths during the night. In other words, during the day it is to be found in large quantity at the bottom; during the night the trawlers will find it only occasionally and not in worthwhile quantity. For this reason fishing for the hake with hook and line, which is no longer practiced, used to be done only at night and at intermediate depth. The depth at which the hake swam in quantity was determined by various trials at different depths, and in many cases it appeared that the hake could be found a few meters below the surface. Various attempts have been made to invent a copada [purse sein?] which would allow night fishing for hake at intermediate depths, but none have yielded satisfactory results, to my knowledge.

"These facts relative to hake fishing result from the habits of the fish. During the day the hake does not feed much and probably sleeps, at night it seeks its food, and, as its diet consists almost entirely of pelagic fish, like the herring, the sardine, etc., it moves from the bottom to the depths where the pelagic fish are to be found.

"All the ocean fish are more or less migratory in their habits, but the hake is a great migrant (sic). The movements of the fishing fleets and the positions ~~nowhere~~ where the catch is the best at the different times afford indirect information on the hake's migrations.

"The principal seasonal migration is based on water depth.

"During the winter the hake moves toward the deeper water; during the summer, into the shallower. Interesting evidence of these movements was obtained when a fish marked in 1931 and cast back into the sea off Ballycotton at a depth of 38 fathoms was caught ~~at~~ at a depth of 170 fathoms off Fastnet in April 1932. There is little reason to believe that there occurs a north-south migration. The evidence points rather to the conclusion that the hake tends to remain almost all its life in approximately the latitude in which it was spawned.

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"On the evidence afforded by the season of the largest catches of adult hake, however, there appears to exist a movement toward the north. Thus, south of Ireland, fishing is best in May and June; to the west, in June and July; and along the west coast of Scotland, in June (sic) and August. But this trend north is more due to physio-chemical conditions (such as temperature and salinity) necessary for spawning than to any thing else.

During and before spawning the hake necessarily gather together and therefore yield better than average catches.

During the summer and fall, the young hake, in their turn, congregate in the shallower waters while the shoals of adult fish scatter. Thus while maximum catches of the adult hake occur from May to August, the greatest hauls of the young fish do not come until the latter part of the year (August-September)

"Since bottom-living hake are now seldom caught and since the young fish are relatively abundant, the best overall hake catches occur only in July, August, and September.

"On the other hand in the prewar years, 1914-18, (sic) when the bottom-living hake were still plentiful, the largest hake catches (catches of hake as a whole, both young and adult, came somewhat earlier in the year, in May, June, and July.

"We have already said that the hake seek the deep waters in winter and gather along the sides of the trenches. This concentration still results in better fishing, which in that case is carried on at a depth of 100 to 300 fathoms or more.

"In the shallower waters winter catches consist almost entirely of young hake; at greater depth scarcely any but the large hake are to be found.

"Information on the growth of the hake has been obtained in various ways. For the fish occurring to the south and east of Ireland the figures on size at the different ages are as follows:

1 year - 10 cm

2 years - 20 cm

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3 years - 26 cm	7 years - 60 cm
4 years - 35 cm	8 years - 68 cm
5 years - 42 cm	9 years - 74 cm
6 years - 51 cm	10 years - 80 cm

The male grows more slowly than the female. This fact is due to the early maturity of the male which matures during its third year while the female does not mature until its eighth year. Adult males can be found not over 20 to 24 centimeters long, while the females, by the time they are adult, have attained a length of 60 to 70 centimeters. The male hake must begin early to reserve the necessary nutritional elements for the maturing of its testicles.

Furthermore, the amount of sperm produced in each breeding season, increases rapidly, imposing a heavy burden on the fish's growth until finally, (at an age when the female has not yet matured) growth ceases altogether. It is furthermore probable that the great effort (this strain) is sustained beyond the period [when growth stops] and ultimately causes the death of the male, for the proportion of males to females, which is 1,140 to 1,000 for two-year old fish, drops to 210 to 1,000 for eleven-year old's while hake over twelve years old and more than 90 centimeters long are almost always females.

There is a time pattern for the fish's growth. While its length increases by about 6.5 centimeters per year, its weight, a matter of greater interest to the fishing industry, shows a yearly gain of 70 percent from the third to the seventh year. During the period its value rises two and a half times each year.

"Fishing captains and owners should pay particular attention to these last figures and operate carefully, using nets with large mesh to prevent, in so far as possible, the destruction of the young hake, which will serve to replenish the stock of fish on which the industry's existence depends.

Although hake are the most important species in trawling operations, trawls are also used to catch other kinds of fish, some bringing very

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good price, some of poor quality which are classed together as "small fish". These other kinds of fish include:

The Turbot, belonging to the family of the Pleuronectidae, usually found at depths of 80 to 100 fathoms: This fish migrates and for that reason is sometimes found very close to the coast. It grows to a length of about 80 centimeters and spawns in very shallow waters in the North Atlantic during April to August. It brings a good price.

The dory, also of the family of Pleuronetidae. Its eyes are on the left side, differing in this respect from the sole and the pegusa whose eyes are on the right. The dory thrashes about a great deal in the trawl. It is easily recognized by its big eyes and mouth and its four dark spots on the left side close to the tail. On that side it is usually of a greyish or yellowish color. It attains a length of 30 centimeters and lives both on sand and mud bottoms. It is a medium-quality fish.

The sole. The solea solea as Linnaeus named it, belongs to the family of the Soelidae and attains a length of some 45 centimeters. Its body is asymmetrical, mottled brown on the right side, where the eyes are located. In the North Sea the spawning season lasts from April to August. As the fish grows, it abandons its free-swimming life and moves to the bottom where it generally remains still, often burying itself in the sand so that only its eyes show. It lives in coastal waters during the summer and moves to deep waters during the winter. There are other kinds of Soelidae, for example, ~~rockallidae~~ the pegusa, but it is easy, of course, to tell the sole from them since it is the best known because of the high price it commands.

San Pedro fish (also known as San Martin or San Martino). It has an extremely compressed, oblong body which reaches a length of 60 centimeters. It is easily recognized by the characteristic black spot with a lighter edge on each side. It lives at considerable depth and belongs to the Zeidae.

Red Mullet It brings a very good price. It is characterized by a

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pair of movable barbels under the lower jaw. The fish is red and has large scales which come off easily. It attains a length of 30 centimeters. The red mullets inhabiting the bottoms are caught on mud and sand bottoms alike. They can easily be distinguished from the other kind of red mullet, known as the coastal or rock mullet. The former has a truncated snout like the mouth of a flute, while in the latter the snout is of normal length. Both kinds belong to the family of mullidae.

Seabream It has a deep, compressed body, large eyes, short snout, and general reddish coloring. It attains a length of 50 centimeters. Belonging to the family of the Sparidae, it can easily be recognized, not only by its coloring and shape, but also by the black spot at the base of the lateral line, which, however, does not appear until the fish is 10 or 12 centimeters long. The inside of its mouth is red. It is well received on the market.

The red gurnard This genus comprises various varieties having similar habits. The red gurnard has a large, slanting head, bony and streamlined body. It is red and attains a length of 40-50 centimeters. The newly spawned fish, are found close to the bottom in shallow water, where they are carried by the currents. As they grow they retire to deeper waters. This fish belongs to the family of Triglidae. It is not a choice fish and brings only a moderate price.

The trawls also catch large quantities of Gadidae, such as the codfish, the whiting pout, brotola, etc; the rape of the family of the Lophidae; the palometa roja, belonging to the family of the Mericidae (?); conger eels of the family of congridae; rays - the common skate, the Santiago ray, the bramante, the noriega, and the picon, belonging to the family of the Rajidae; the sting-ray which is very much like the ray but belongs to the Dasybatidae and which, close to the tail, has a barbed spine capable of inflicting severe wounds, very painful and slow to heal; the eagle ray belonging to the family of the Myliobatidae which has a poisoned barb like that of the sting-ray and also has a long tail like a whip.

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The electric ray, of the family of Torpedinidae. It has a disc-shaped, cinnamon-colored body with five blue ocelli surrounded by a black ring and a light outer band. "hen the fish is touched, it gives an electric shock which does not do much harm, however.

The angelote, one of the Squatinidae. It has a pair of large flat fins extending from the head, one on each side, and has no anal fin.

Finally, the trawls also catch a considerable number of alitan of "sea cat" of the family of Scyliorhinidae, small sharks of the family of the Galeidae, such as the cazon [squalus galeus], the lobo, and the musola, and of the family of the Squalidae; such as the mielga [squalus centrina—a kind of dogfish]; the quelvacho and the galludo.

This gives a rough idea of the fish caught with trawls.

COASTS OF NW FRANCE, SW ENGLAND AND SOUTHERN IRELAND

The Submarine Continental Shelf

The continuity between continents and sea bottom is not generally broken suddenly, but the coast continues under the sea in a gradual slope until it reaches a depth of some 200 meters on the average. Beyond this line of equal depth a great drop marks and separates this zone from the abyssal or great-depth zone.

The strip lying between the shore and the 200-meter isobath, called the continental shelf, is of importance from the fishing viewpoint because it abounds in biologic variety and is therefore the most suited to fishing.

The extent of the continental shelf is very variable. In some places it is so limited that it hardly exists, as in the case of the South American Pacific coast, and in ~~the~~ other cases it is very wide. NW France, SW England and Southern Ireland are such. We shall discuss these broad strips briefly.

Many ~~sea~~ oceanographers have studied this great shelf but none so well as Mr. Edouard de Danois, the French professor.

During the tertiary era and at other times, England and Ireland formed a continuation of continental Europe. The North Sea, the

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Channel, St. George's Channel and the Irish Sea did not exist. Repeated geologic convulsions caused the last 3 bodies of water. This area, lying between the littoral and the 200-meter depth contour must be regarded as an old submerged plain which is closely related to the emergent land bordering it. The oceanic limit of this continental shelf follows the coastal direction of which it is an extension.

Looking at the map accompanying this study we see first the great sunken Bay of Fastnet, a continuation of the present Bantry Bay. It follows the broken line of this disappeared coast, forming a great inlet on the Grand-Sole fishing grounds, and beyond the latter Melville Bay indents the coast; this line then proceeds toward the French coast, gradually nearing land and becoming more regular, thus reducing the breadth of the shelf until it is very narrow on the south of France in the so-called Breton Trench. The depth of this rim is to be found between 130 and 180 meters. To prove that this shelf once belonged to the Continent, we need only examine its topography. It is cut by valleys which according to Le Danois are the old courses of the present rivers. In the attached map traced on the basis of the French oceanographer there are 2 main basins: the Severn and the Seine. The Severn basin, which now empties at the head of Bristol Channel, formerly emptied near the Grand-Sole Bank, after collecting the waters of the Blackwater and Barrow from Ireland, and the Avon and others from England. The Seine basin used to discharge near the present Parsons Bank, east of Petit-Sole, after collecting tributaries of France such as the Orne, Vire, Couesnon, Aulve, etc., and others from England.

There is another submersion, of minor importance, off the presently submerged Seine basin, near the 50th parallel, called Hurd Deep, which Le Danois calls Fosse Centrale. It has been confirmed by soundings. This is a gorge over 100 km long, sunk about 12 meters below the general level of the shelf. There remains to be determined the geologic epoch of this submersion. It may have happened in the glacial period.

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FISHING

Situation by Grid

The shipmaster afloat and the shipowner ~~ashore~~ ashore can easily communicate by radiotelephone by referring to the ships position within one of the 226 grids situated between parallels 37-54 N and meridians 1 to 15W. This eliminates exact observations which are of no use in normal procedure.

The CHART shows the courses and distances from the Cantabrico area and the northeastern part of the Peninsula to the starting points for working the GRAND-SOLE and PETIT-SOLE

Grand Sole Fishing Area

Lat. 48° 50' N

Long 10° 30' W

This location may be considered as the arrival and beginning point for work in any direction, according to sounding desired. Sounding lines are shown on the chart. Care must be taken ~~known~~ to avoid coral reefs and hulls of sunken ships, as well as deeps, that is, off the edge of the ~~main~~ continental shelf.

The codillo area, which is approximately on the latitude given above, is one of the best fishing grounds. This ~~extensive~~ extensive zone lies from 48° 50' N to about 51°, joining the Fastnet grounds, and is considered the Grand Sole. The approximate indication of sunken hulls is ~~proof~~ proof of the frequented grounds.

Petit Sole Fishing Area

Lat. 48° 17' N

Long 8° 55' W

This is the starting workpoint in a depth of 200 meters. There is coral and some loose rock to the west which would ruin the lines. No information can be given on direction of courses, as any heading is good except near the coral. It may be convenient to follow the chart lines ~~work~~ as the bottom is very variable and the exact position of the loose rock is unknown. Many captains and masters consider it dangerous, leaving it somewhat ~~unexploited~~ unexploited.

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The Cockburn, Labadie, Jones, Melville, Shamrock, Parsons, etc. Banks are elevations of the continental shelf, all of which shelf is a ground between parallels 48 and 54. Almost all of this area is good for trawling. As a general rule, hake and fry are caught here between 90 and 200 fathoms depth. The shallower bottoms are good for flat fish and leather hides, as the fishermen call the scylliorhinidae, galeidae and dogfish in general, even when there are hake in these shoals, because fry is almost always found in greater depths.

When the catch is poor between parallels 49 and 51, it means the fish are farther north. From March to May, fish between 49 and 51, and from May to September, between 51 and 54. In October the fish are back between 49 and 51 but they are smaller.

Seabream is plentiful seasonally between the 49th and 50th parallels. From 50° northward there is dory of good size.

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